

Oct. 13, 1981

Based upon the results of the Arriaga field test, the program recommendations of the Univ. of Texas and USDA research groups are very similar. These recommendations include that (1) factory strains be developed from local native populations without forced crosses, (2) sterile release strains be matched chromosomally with target populations to perhaps increase mating efficiency, and (3) native populations be sampled for chromosomal variation as much ahead of sterile releases as possible. The Univ. of Texas and USDA positions on this matter differ primarily in degree (esp. in the relative strength of reproductive isolation among screwworms). In my view, resolving these differences will not materially affect the basic program recommendations of either research group. However, such differing views can, and should, be examined through the forum of peer reviewed scientific journals.

If it is contemplated having a review panel arbitrate over the Univ. of Texas and USDA data it would be necessary to consider the difficulty in obtaining truly impartial referees and the possibility of a mixed opinion outcome. Of course, I remain fully prepared to cooperate with such an investigation. Also, I feel that the relevant data of Ray Gagne should naturally be included in any comprehensive review.

Regardless of the manner in which the aforementioned differences of opinion are aired, I strongly believe that either one, but not both, of the two research groups should be funded in the area of screwworm population genetics unless their respective duties can be clearly defined and separated. This should be done because our relationship to date has been largely competitive and duplicative, rather than cooperative.

Don McInnis

Don McInnis
Research Geneticist

WORKING PRIORITIES (D. McInnis)

1. ARRIAGA test material

- a) finish larval chromosome analysis - write Paper
- b) " dissecting trapped adults
- c) analyze & report on strain evaluation - write Paper

2. SWASS field tests

- a) Colima material } write Paper
- b) Veracruz "

3. Adult dissection data from various areas - write Paper

- a) review of previous studies plus recent Veracruz, Colima, & Arriaga data
- b) association of weather data w/ fly number & quality

4. Collaborative work w/ Tuxtlas

- a) monitor new factory strains (currently Arriaga)
- b) mating choice tests w/ chromosomally distinct lines ~~data~~ including C. maculifera - write Paper
- c) w/ McHale's: multiple strains & larval size

5. Altitudinal survey of SW ground Tuxtlas - write Paper

6. Sperm Identification (sterile or fertile) in ♀♀ spermathecae - write Paper

7. Survey of SW chromosome variation from Aldama, Smilaca, Veracruz, Colima, and Arriaga - write Paper

Ratio

↓

2, 3, 4, 5, 6

- ① X:Y
- ② Autosomes in decreasing length
- ③ Y & chromosomes in decreasing order of element lengths (arms)
X=1 arm

heterotypes determined
by Q banding patterns

- Defend report

- Proposal
- continuing

LIC-3

length &
Q-banding
differences

heterozygotes in X-somes

print at high
contrast

- picking cells
multivariate analysis

5 diploid
Type F ♀♀'s

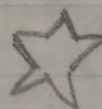
in multiples
of 4

DNA quantity
genome size vary

5 heterozygous
individuals
♂♂'s & ♀♀'s

outside
of genome

Type Long X
" Short X



we needed a MAP

Whitten

Suggestions for Research Priorities

August 28, 1980

Where is a
bait station

I. Biochemistry and Genetics Group - Mission, Texas

Short Term:

- A. Studies of genetic and isozyme patterns of screwworms from the Mexican states of Veracruz, Colima and Yucatan (Whitten, McInnis). *(Hugh I derive new strains from collected genetic material)*
- ✓ B. Develop procedures for selecting males only strain (Rawlins).
- C. Investigate the field effectiveness of a narrow genetic base strain (Joint effort).
- D. Investigate genetic and isozyme patterns of screwworms from Costa Rica (Whitten McInnis).
- E. Continue laboratory studies on selected large fly strain and conduct field investigations of the effects of fly size on overall effectiveness.
- ✓ F. Assist with field evaluations of newly developed strains of screwworms (Whitten, Coppedge and McInnis).
- G. Investigate accuracy of native male screwworm identification techniques in the field (McInnis and Tannahill).
- H. Investigate accuracy of sperm identification techniques in the field (McInnis and Tannahill).
- I. Initiate studies on the effectiveness of Avermectin (Merck MK-933) against screwworms (Rawlins)

Swarmline selection by SWASS

Long Term:

- A. Complete studies of genetic and isozyme patterns of screwworms in southern Mexico (Whitten and McInnis).
- B. Initiate studies of population genetics of the screwworms in Central America; characterize genotypes and their behavior (McInnis).
- C. Conduct large scale field comparison of genetically selected large and small screwworm flies.
- D. Conduct large scale field test of males only strain of screwworms.

(2)

II. Biochemistry, Genetics and Attractant Unit - Fargo, North Dakota

Short Term:

- oviposition*
Bioassay *attractancy only* *mating stimulant*
water-soluble's only
- A. Isolate screwworm feeding and/or oviposition attractant (Hammack). *variability in bioassay results is problem*
 - B. Investigate bacteria production of screwworm attractants (Hammack and Brommel). *wound attractant is bacterial in nature*
 - C. Isolate attractive fractions from flower extracts (Hammack, Terranishi and Mackley). ? *Mating stimulus*
 - D. Isolate fractions from manure that are attracted to screwworms (Hammack, ? and Mackley). ?
 - E. Develop technique for isolating polytene chromosomes from the screwworm (?). *(Long term)*

Long Term:

- 5 yr.*
- A. Develop and field test an "artificial wound" as a technique for obtaining screwworm egg masses in the field.
 - B. Develop a ovipositional attractant for screwworms and determine how this attractant can be used to increase egg production in mass rearing.
 - C. Isolate and identify screwworm attractants from flowers.
 - D. Isolate and identify screwworm attractants from manure.
 - E. Establish small colony of *Chrysoma bezziana* for biochemical and genetic studies.

III. Ecology of the Screwworms in Southern Mexico

Short Term:

- A. Investigate the biology and ecology of the screwworms in the Yucatan (Mackley).
- B. Investigate the seasonal incidence of screwworms in the areas of Mexico from Veracruz to Tuxtla and from Mazatlan to Tuxtla (Spencer).
- C. Investigate the population dynamics of the screwworms in southern Mexico; especially natural mortality factors (Spencer).
- D. Investigate the seasonal incidence of screwworms in the northernmost area of Costa Rica (Graham).

- E. Investigate effects of routine insecticide treatments for ticks on screwworm infestations (Graham).
- F. Determine the effectiveness of Avermectin (Merck MK-933) under field conditions (Graham). *Merck*
- G. Investigate the effectiveness of sticky traps in detecting screwworms in areas where sterile flies are not being released (Mackley).
- H. Conduct field evaluations on the effects of a combination of SWASS (or bait station) - chemosterilant on egg fertility of a field population of screwworms (Spencer).

Long Term:

- A. Develop a good understanding of the biology and ecology of the screwworms in southern Mexico.
- B. Estimate the seasonal incidence of screwworms in Central America by regions.
- C. Determine level of effectiveness of SWASS that can be expected in the wet tropics of Mexico and Central America. *4 longed-lived*
- D. Develop sensitive trapping systems for use in southern Mexico.

IV. Ecology SWASS and Chemistry - Mission, Texas

Short Term:

- A. Determine reasons for reduced effectiveness of swormlure baited traps in southern Mexico (Peterson).
- B. Investigate effectiveness of SWASS at a location in southern Mexico (pending until additional funds recieved).
- C. Select and evaluate new insecticides for use in SWASS (Peterson and Coppedge) *Dylox - safer, longer residual (Zida) Dursban*
- D. Investigate methods of extending the release of swormlure from SWASS (Tannahill).
- E. Investigate the field effectiveness of solid formulations of SWASS (Tannahill).
- F. Determine the effectiveness of bait stations in reducing screwworm populations.
- G. Investigate effects of dried blood quality on screwworm growth and development.

+ APHIS wants to know

(1) Make sure SWASS works in S. Mexico

(2) How much can SWASS suppress a native population w/o sterile flies.

(3) More info on swath widths & dosage

3 day ellet with regard to swormlure

Long Term:

- A. Develop a long lasting formulation of SWASS.
- B. Develop bait stations to the point they are ready for operational use by APHIS.
- C. Develop trapping systems for use in southern Mexico and Central America.
- D. Develop quality control standards for dried blood.

V. Miscellaneous

Short Term:

- ◇ A. Continue evaluations on the effectiveness of synthetic pyrethroids and chemosterilents on housefly populations in rearing facilities (Woodard). *a passive system*
- ◇ B. Investigate effectiveness of SWASS being distributed from remote holding facilities (Woodard).
- ◇ C. Construct CO₂ analyzer and determine if it can be used as a quality control measure (Coppedge and Woodard).

1[#]/sq mi

10

Methods Development and Research Coordination Meeting

Suggested discussion topics, August 29, 1980.

- 1. Future strain development procedures
- 2. New strain evaluations
- 3. Arriaga test (narrow genetic base strain)
- 4. Housefly control in Tuxtla Plant
- 5. Quality control of Swermlure and SWASS
- 6. Quality evaluations of SWASS in the field
- 7. Trapping Surveys in Central and Southern Mexico
- 8. New trapping procedures

500 mi²

6 g
7 0000

250,000 twice weekly

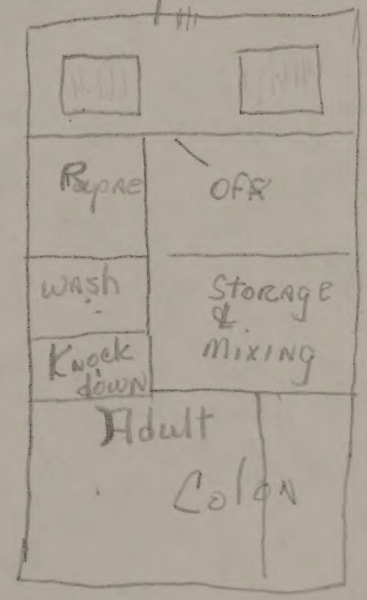
- Surveillance
on Baja

- Choix

- Rio Nazas

- Marz

Chilled flies



Arriaga Exp
Info to Vargas
& Hoffman

Research Priorities for Major APHIS Programs

SCREWORM ERADICATION

FY 82

The highest priority for APHIS in FY 82 and subsequent years is screwworm development. Although no longer a purely research function, it is, nevertheless, of paramount importance to the success of the program and should continue as a cooperative activity between APHIS program personnel and ARS scientists. The second order of priority will remain to be SWASS-swormlure enhancement in humid tropical areas. Genetic population characterization assumes the third order of priority - specific direction of this research will be reassessed following completion of the technical panel study of the possibility of reproductive isolation between screwworm populations. Screwworm ecology in Southern Mexico must continue in advance of the eradication program. Fifth in priority is the improvement of screwworm diet. Other priorities of somewhat equal importance are the development of alternative attractants (both feeding and oviposition attractants), development of an "all male" strain, and the development of systemic insecticides for regulatory use.

FY 83

The first three priorities of FY 82 (strain development, SWASS enhancement, and genetics) remain unchanged for FY 83. Ecological research should begin to advance into Central America. The importance of developing alternative attractants should advance to fifth priority. Research should continue on development of an "all male" strain, diet improvement, and systemic insecticides for regulatory use.

FY 84

Strain development continues as the first priority. Assuming that the question of SWASS effectiveness in the humid tropics has by now been resolved, research on insect genetics (including development of an "all male" strain must now assume greater prominence with a budget increase of \$250,000 divided between the Fargo and Tuxtla Gutierrez locations. By now, a major effort, which will require a budget increase of \$250,000 by the Tuxtla Gutierrez location, will be required to intensively study screwworm ecology in Central America. A significant research effort must be maintained for SWASS enhancement, alternative attractants, diet improvement, and systemic insecticides for regulatory use.

Long-Range Goals

With the long-term objective of extending screwworm eradication through Central America in mind, ecological and biological research, as well as genetic characterization of screwworm populations, are of high priority importance. The development of an "all male" strain must continue to receive research priority because of its potential of reducing the cost of maintaining a barrier zone. Continuing efforts will be necessary to improve diet, develop alternative attractants, and develop systemic insecticides for regulatory use.

DRAFT

Research Priorities for Major APHIS Programs

Whitten

ARS Staff

APHIS Staff

Date: 2/9/82

Name: R. A. Bram

Name: F. E. Smith

APHIS Program: Screwworm Eradication

Position: NRPL

Position: Chief Staff Veterinarian

Current ARS Research Activities		APHIS Research Needs in Priority Order			
	SY	FY 82	FY 83	FY 84*	Long-Range Goals
1. Strain development	1	1. Strain development	1. Strain development	1. Strain development	1. Strain developmen
2. SWASS-swormlure enhancement	2	2. SWASS enhancement	2. SWASS enhancement	2. Genetics (population characterization and all male strain)*	2. Ecology in Centra America*
3. Genetics (population characterization and sexing)	3	3. Genetics (population characterization)	3. Genetics (population characterization)	3. Ecology in Central America*	3. Ecology in South America*
4. Other attractants	2	4. Ecology in Southern Mexico	4. Ecology in Central America	4. SWASS enhancement	4. Genetics (populat characterization all male strain)
5. Field biology and ecology	2	5. Diet improvement	5. Other attractants	5. Other attractants	5. Other attractants
		6. Other attractants	6. All male strain	6. Diet improvement	6. Systemic insecti-cides
		7. All male strain	7. Diet improvement	7. Systemic insecti-cides	7. Diet improvement
		8. Systemic insecti-cides	8. Systemic insecti-cides		

DRAFT

*Items identified with an asterisk will require budget increases, redirection of resources, or other program adjustment for initiation in FY 84.



United States
Department of
Agriculture

Agricultural
Research
Service

North Central Region
Metabolism and
Radiation Research
Laboratory

Whitten
P.O. Box 5674
State University Station
Fargo, North Dakota
58105

August 31, 1982

SUBJECT: Research Plans September 1 - December 31, 1982

TO: Dr. O. H. Graham, Research Leader
Screwworm Research Laboratory
Post Office Box 986 Moore Air Base
Mission, Texas 78572

In cooperation with a chemist, proceed with chemical isolation of dried blood attractant(s) using an olfactometer bioassay to monitor attractant activity in isolated fractions. Attractant was recovered in the steam distillate of crude reconstituted blood but lost after lyophilization of the distillate. Attempts to extract attractant with nonpolar solvents failed: either it remained in particulate or aqueous residues or activity was recovered only after recombination of polar and nonpolar solvent fractions. Chromatography of the steam distillate on Porapak Q will be done, using polar solvents (methanol-water), and subsequent fractionation methods will be developed based on the attractant recovery pattern obtained after this chromatographic separation.

The attractant in reconstituted dried blood lures females but not males. Exposure of females to fresh unattractive blood prior to bioassay obliterates attraction of vitellogenic-stage insects to the dried blood but only slightly and transiently reduces the response of gravid females. Thus, the response profile is consistent with that obtained to the sentinel sheep wounds used to monitor field populations.

Further work is needed to define the conditions required for optimal wound attractancy and to develop methods to standardize these conditions before the wound can be considered a source of attractant suitable for chemical isolation studies. This work is hampered in part by variability among batches of insects in responsiveness to attractant, and more than half of this variability is traceable to as yet unknown factors operating prior to the pupal stadium. Chemical isolation of the dried blood attractant is feasible because it is stable in storage for at least 3.5 years, available in quantity so that biological and chemical studies can be done, using a single blood batch, and, unlike the wound fluids tested thus far, it produces a quantitative relationship between attractant concentration and response in olfactometer tests. Thus, the crude blood can be used as a reference standard to monitor sensitivity of different batches of insects used for bioassay and to estimate attractant yields following fractionation procedures.

Leslie Hammack

Leslie Hammack, Research Entomologist
Insect Physiology/Biochemistry Section

cc: Dennis R. Nelson
James C. Whitten ✓

- Phenomones?

(— umbilicals
can we sample
bacteria)

Brennen

- releasing & determining carbohydrate diet (crop sugars)
- comparing A-82 & V-81 (perhaps)

Hanold

- SWASS - water resistance
(butyl alcohol repellent to gravid ♀♀)

Mackley

- Swormlure IV
comparing with Swormlure II
- Microbes - short range attraction protocol
- Pellets - size
 ↓
 slow-release
 pellet mill operation
- Feeding patterns
 physiological & chronological

Mangan

- Larval morphology
 - spine morphology - influence of age in variation
 - mouthparts
- Mating behavior
 - time in copulation
 - fertility

SCREWORM RESEARCH AT FARGO

1. PHYSIOLOGY

- A. Wound attractants - Hammack and Pomonis
- B. Oviposition attractants - Hammack and Pomonis
- C. Microbiology of screwworms - Bromel; cooperator, North Dakota State U.
- D. Flower attractants - Whitten and Flath (WRRC, Berkeley, CA.)

2. GENETICS

- A. Genetic sexing mechanism - Whitten
- B. Genetic compability - Whitten and LaChance
- C. Meiotic chromosomes - LaChance
- D. Polytene chromosomes - Post-doctoral appointee in cooperation with NDSU.
- E. Population genetics (isozymes) - Whitten

- 2.10 Herida artificial.
- 3.0 Comisión.
- 3.1 Dieta para adultos
(6 meses)
- 3.2 Dieta larvaria
(6 meses)
- 3.3 Edad de irradiación
(1 mes)
- 3.4 Velocidad adecuada de dispersión aerea.
(1½ mes)
- 3.5 Dispersión en cañones
(6 meses)

— Chilled fly releases ?

PRIORIDADES DE INVESTIGACION PARA EL PROGRAMA

- 1.0 Comisión - A.R.S.
- 1.1 Estudio de Oogenesis
(6 meses)
- 1.2 Motilidad espermática
(6 meses)
- 1.3 Determinación del peso larvario ideal
(1 año)
- 1.4 Nueva trampa
 - Económica
 - Fácil uso
 - Almacenaje
 - Transporte
(1 año)
- 2.0 A. R. S.
- 2.1 Determinación de las B.T.U. (Britihs Termical Units)
que generen las moscas y pupas.
- 2.2 Obtención de nuevas variedades.
- 2.3 Formación de un Banco Genético.
- 2.4 Desarrollar un sistema que detecte a tiempo, cuando
deberá ser sustituida la variedad.
- 2.5 Reevaluación del SWASS
 - Zonas tropicales.
- 2.6 Nuevos atrayentes.
 - Fácil utilización.
 - Transporte
 - Muy específico para G.B.G.
- 2.7 Estudios ecológicos en la zona de la barrera.
- 2.8 Competencia sexual de machos
- 2.9 Estrés al CO_2 durante el transporte.

APHIS/ARS Priority FY 83	APHIS/ARS Priority FY 84	Technical Panel Recommendations	Lincoln-Eden Recommendations	Base ARS Research Effort	ARS Additional Research Requirements	Necessary Resources (Increases)		
						\$(000)	SY	Location
1. Strain development	1. Strain Development	2. Improve factory strains (9. propagation by fly-choice methods.)	1. Strain construction. 2. Hybridized strains. 3. Male-only strain.	I. Strain development. a. Peterson - Tuxtla. (100%)	1. Basic genetic research on population characterization. 2. Nutrition & growth	150 50	1	Fargo Beltsville
2. SWASS enhancement (5. Other attractants)	4. SWASS enhancement (5. Other attractants)		4. Surveillance and attractants. (Bioassay procedures) (Oviposition stimulants) (Sex pheromones) (SWASS improvement)	II. SWASS enhancement and attractants. a. Mackley - Tuxtla. (100%) b. Hammack - Fargo. (100%) c. Brown - Weslaco. (25%) d. Flath - Berkeley. (10%)	3. Strain deterioration. 4. Chemistry of attraction. 5. Population dynamics. 6. Supplemental control technology. 7. Mating behavior.	350 50 200 150 50 200 200	2 1 1 1 1	Tuxtla Gainesville Tuxtla Fargo Berkeley Tuxtla Tuxtla
3. Population characterization. (Genetics)	2. Population characterization. (Genetics)	3. Population characterization. (1. Isofemale lines) (2. New methods to define populations) (4. Taxonomic studies) (5. Basic screwworm genetics)	6. Population dynamics, ecology, and genetics South of Isthmus.	III. Genetic characterization of populations. a. McInnis - Tuxtla. (100%) b. LaChance - Fargo. (33%) c. Mangan - Tuxtla. (50%) d. Whitten - Fargo. (50%)	TOTAL	1,600	8	
4. Ecology (Central America)	3. Ecology (Central America)	2. Field biology	5. Field ecology (Life table) (Flight behavior) (Age of adults) (Source of sperm)	IV. Field ecology a. Mangan - Tuxtla. (50%) b. Graham - Tuxtla. (50%) c. Brenner - Tuxtla. (75%) d. Ring - Tuxtla. (50%)				
6. All male strain		7. Male only strain	5. Male only strain	V. All male strain a. Whitten - Fargo. (50%)				
7. Diet improvement	6. Diet improvement.	6. Mating behavior	7. Nutrition and growth. (Measurements of fly quality) (Minimum requirements for rearing)	VI. Nutrition and growth. a. Brown - Weslaco. (5%) VII. Population dynamics. a. Ring - Tuxtla. (50%) b. Brenner - Tuxtla. (25%) VIII. Chemical control. a. Spencer - Tuxtla. (25%) IX. Rearing and dispersion. a. Spencer -				
8. Systemic insecticides.	7. Systemic insecticides.	11. Parasites and predators.						



United States
Department of
Agriculture

Agricultural
Research
Service

National
Program
Staff

Beltsville, Maryland
20705

October 5, 1982

SUBJECT: FY 83 Budget Increase Requirements for Screwworm Research

TO: T. J. Army, Deputy Administrator, NPS

THROUGH: D. B. Laster, Interim Coordinator, AHNPS

15/10/82

Background: The Lincoln-Eden Study of the Screwworm Eradication Program recommended that the ARS screwworm research effort be increased to \$3 million and 15 SY's for FY 83 with inflation increases in subsequent years. This recommendation is appropriate and fully justified and, if implemented, would increase the research effort to a modest 6% of the eradication budget. The ARS FY 82 budget for screwworm research was \$1,269,248 and supported approximately 10 SY's. (See enclosure.)

Anticipated Increases: An increase of \$150,000 for screwworm research at Fargo is included in the FY 83 Animal Health and Protection budget package. The FY 84 Science and Education special analysis for Animal Science Research to Support APHIS includes an increase of \$200,000 for screwworm research at Tuxtla Gutierrez, Mexico. No other increases for screwworm research have been budgeted.

Recommendations: Although it would be extremely difficult to identify a \$1.6 million increase to accomodate the Lincoln-Eden recommendation, it will be possible to partially meet the necessary requirements by the following actions in FY 83 and FY 84.

- Assure that the \$150,000 increase for screwworm research at Fargo receives highest priority in the FY 83 implementation plans.
- Provide \$200,000 from FY 83 Administrator's or Regional Contingency Funds for screwworm research in Tuxtla Gutierrez with the anticipation that the FY 84 budget will contain a similar increase in base support as proposed in the Science and Education special analysis.
- Redirect \$100,000 from the activities of the Biological Control Research Unit, College Station, Texas, to supporting research on screwworm nutrition and growth.
- Redirect \$100,000 from the activities of an insect biochemist to supporting research on the chemistry of screwworm attraction.
- Intensify cooperative activities between ARS scientists and methods development personnel at Tuxtla Gutierrez with emphasis on strain deterioration, nutrition, and growth.

With your concurrence, I will proceed to implement these recommended actions.

Ralph A. Bram

RALPH A. BRAM
National Research Program Leader
Insects Affecting Man & Animals

Enclosure

cc: R. F. Barnes
J. R. Johnston
O. H. Graham
P. J. Fitzgerald
K. L. Lebsock
C. J. Whitten

REFERENCE SLIP

11/24/82

TO

Dr. C. J. Whitten
Fargo, ND

☐ ACTION☐ NOTE AND RETURN☐ APPROVAL☐ PER PHONE CALL☐ AS REQUESTED☐ RECOMMENDATION☒ FOR COMMENT☐ REPLY FOR SIGNATURE OF☐ FOR INFORMATION☐ RETURNED☐ INITIALS☐ SEE ME☐ NOTE AND FILE☐ YOUR SIGNATURE

REMARKS

I in:

Attached is the
draft of research priorities.
I would appreciate your
comments for inclusion in the
final list.

Thanks.

FROM

Ralph

DRAFT

RESEARCH PRIORITIES FOR MAJOR APHIS PROGRAMS

ARS Staff

APHIS Staff

Date: November 24, 1982

Name: R. A. Bram

Name: F. E. Smith

APHIS Program: Screwworm Eradication

Position: NRPL

Position: Chief Staff Officer

Current ARS Research Activities		APHIS Research Needs in Priority Order			
	SY	FY 83	FY 84	FY 85	Long Range Goals
1. Strain development	1	1. Strain development	1. Strain development	1. Strain development	1. Strain development
2. SWASS-swormlure enhancement	2.35	2. Attractants, including enhancement of swormlure	2. Attractants, including enhancement of swormlure	2. Attractants, including enhancement of swormlure	2. Ecology in Central America
3. Genetic characterization of populations	2.33	3. Genetics (population characterization, hybrid vigor and all male strain)	3. Genetics (population characterization, hybrid vigor and all male strain)	3. Genetic population characterization in Central America and the Caribbean*	3. Attractants
4. Field ecology	2.25	4. Ecology and population dynamics in southern Mexico	4. Ecology and population dynamics in the Isthmus of Tehuantepec	4. Ecology and population dynamics in Central America and the Caribbean*	4. Genetic population characterization in Central America, the Caribbean, and South America
5. All male strain	0.5	5. Diet improvement (larval and adult)	5. Strain deterioration	5. Diet improvement, stress, and strain deterioration*	5. New rearing technologies
6. Population dynamics	0.75	6. Strain deterioration	6. Diet improvement and rearing conditions	6. Chemical control technology	6. Chemical control technology
7. Chemical control	0.25	7. Systemic insecticides	7. Systemic insecticides		A joint Research/Methods development planning meeting in Mexico is recommended for late spring 1983 and annually thereafter.
8. Rearing and dispersion	0.75				

* Items identified with an asterisk will require budget increases, redirection of resources, or other program adjustment for initiation in FY 85.

Research Priorities for Major APHIS Programs
SCREWORM ERADICATION

FY 83

Strain development, in cooperation with Methods Development personnel, is the highest APHIS research priority in FY 83 and for subsequent years. The importance of effective screwworm strains, provided on a regular, annual basis, cannot be overemphasized. Of second priority is research on screwworm attractants encompassing not only swormlure-SWASS enhancement, but also the chemistry of attraction and new approaches to screwworm attraction. Genetics receive the third order of priority. Included within this category are research on methods of population characterization, genetic characterization of field populations, genetics of hybrid strains for production, and research on the development of a male only strain. Isofemale lines will be invaluable in these investigations. Of fourth priority is screwworm ecology and population dynamics in southern Mexico, including life tables, mating behavior, flight behavior, and other investigations necessary to devise eradication strategy under different ecological conditions. The improvement of both larval and adult diet is of fifth priority and includes, but is not limited to, geletinized medium and environmental factors such as temperature. Research on the deterioration of strains, both from a genetical and a production management point-of-view is of sixth priority. Although of final priority, research on the use of systemic insecticides is extremely important for maintenance of quarantine lines.

FY 84

The first three priorities of FY 83 remain unchanged for FY 84. By now, research on ecology and population dynamics should be concentrated in the barrier zone. Research on strain deterioration should receive somewhat higher priority, but attention should continue for diet improvement and improvement of rearing technology. Research on systemic insecticides is necessary as new potential products become available.

FY 85

Strain development and research on attractants will continue as the first two priorities. As the eradication program reaches the barrier zone, an increased effort on genetic characterization of populations in Central America and the Caribbean will be necessary. This will require an increase of 1 SY and \$200,000. Similarly, research on ecology and population dynamics in Central America and the Caribbean will necessitate a 1 SY increase and \$200,000. Even greater emphasis should now be given to diet improvement, stress, and strain deterioration with the addition of 1 SY at the production plant and 1 SY at Fargo, North Dakota, along with \$400,000 increased funds for this purpose. The effort on systemic insecticides should be sustained and expanded to include chemical control technology.

Long-Range Goals

The present goal of eradication is to reach the barrier zone at the Isthmus of Tehuantepec by December 1984. Interest has already been expressed by IICA and Ministers of Agriculture to continue eradication through Central America and the Caribbean. Thus, research to support these future initiatives must continue in strain development, ecology and population dynamics, genetic population characterization, new rearing technologies, and chemical control technologies.

DRAFT



United States
Department of
Agriculture

Agricultural
Research
Service

National
Program
Staff

Beltsville, Maryland
20705

December 16, 1982

SUBJECT: Research Priorities--Screwworms

TO: N. L. Meyer
ADA, International Programs, APHIS-VS

Enclosed please find the annual list of research priorities for screwworms in accordance with the Memorandum of Understanding between our agencies on this subject. This list of priorities was jointly developed by Dr. F. E. Smith and me in consultation with scientists and program personnel of our respective organizations.

RALPH A. BRAM
National Program Leader
Insects Affecting Man & Animals

Enclosure

cc:

T. J. Army
D. B. Laster
D. D. King
R. F. Barnes
J. R. Johnston
P. J. Fitzgerald
K. L. Lebsock
O. H. Graham
✓ C. J. Whitten
L. E. LaChance
C. H. Schmidt
F. E. Smith, APHIS-VS

RESEARCH PRIORITIES FOR MAJOR APHIS PROGRAMS

ARS Staff

APHIS Staff

Date: December 16, 1982

Name: R. A. Bram

Name: F. E. Smith

APHIS Program: Screwworm Eradication

Position: NRPL

Position: Chief Staff Officer

Current ARS Research Activities		APHIS Research Needs in Priority Order			
	SY	FY 83	FY 84	FY 85	Long Range Goals
1. Strain development	1	1. Strain development including hybrid vigor	1. Strain development including hybrid vigor	1. Strain development including population characterization	1. Strain development including population characterization
2. SWASS-swormlure enhancement	2.35	2. Attractants, including enhancement of swormlure	2. Attractants, including enhancement of swormlure	2. Attractants, including enhancement of swormlure	2. Ecology in Central America
3. Genetic characterization of populations	2.33	3. Diet improvement (larval and adult)	3. Diet improvement and rearing conditions	3. Diet improvement, stress, and strain deterioration*	3. Attractants
4. Field ecology	2.25	4. Genetics (basic genetics, population characterization, and all male strain	4. Genetics (basic genetics, population characterization, and all male strain	4. Genetic population characterization in Central America and the Caribbean*	4. Genetic population characterization in Central America, the Caribbean, and South America
5. All male strain	0.5	5. Ecology and population dynamics in southern Mexico and the Isthmus of Tehuantepec	5. Ecology and population dynamics in the Isthmus of Tehuantepec	5. Ecology and population dynamics in Central America and the Caribbean*	5. New rearing technologies
6. Population dynamics	0.75	6. Strain deterioration	6. Strain deterioration	6. Chemical control technology	6. Chemical control technology
7. Chemical control	0.25	7. Systemic insecticides	7. Systemic insecticides		A joint Research/Methods development planning meeting in Mexico is recommended for late spring 1983 and annually thereafter.
8. Rearing and dispersion	0.75				

* Items identified with an asterisk will require budget increases, redirection of resources, or other program adjustment for initiation in FY 85.

Research Priorities for Major APHIS Programs
SCREWWORM ERADICATION

FY 83

Strain development, in cooperation with Methods Development personnel, is the highest APHIS research priority in FY 83 and for subsequent years. The importance of effective screwworm strains, provided on a regular, annual basis, cannot be overemphasized; included within this priority is research on the genetics of hybrid strains for production. Of second priority is research on screwworm attractants encompassing not only swormlure-SWASS enhancement, but also the chemistry of attraction and new approaches to screwworm attraction. The improvement of both larval and adult diet is of third priority and includes, but is not limited to, geletinized medium and environmental factors such as temperature. Genetics receive the fourth order of priority. Included within this category are research on methods of population characterization, genetic characterization of field populations, and research on the development of a male only strain. Isofemale lines will be invaluable in these investigations. Of fifth priority is screwworm ecology and population dynamics in southern Mexico and the Isthmus of Tehuantepec, including life tables, mating behavior, flight behavior, and other investigations necessary to devise eradication strategy under different ecological conditions. Research on the deterioration of strains, both from a genetical and a production management point-of-view is of sixth priority. Although of final priority, research on the use of systemic insecticides is extremely important for maintenance of quarantine lines.

FY 84

The first three priorities of FY 83 remain unchanged for FY 84. By now, research on ecology and population dynamics should be concentrated in the barrier zone. Research on strain deterioration should receive somewhat higher priority, but high priority should continue for diet improvement and improvement of rearing technology. Research on systemic insecticides is necessary as new potential products become available.

FY 85

Strain development and research on attractants will continue as the first two priorities. As the eradication program reaches the barrier zone, an increased effort on genetic characterization of populations in Central America and the Caribbean will be necessary. This will require an increase of 1 SY and \$200,000. Even greater emphasis should now be given to diet improvement, stress, and strain deterioration with the addition of 1 SY at the production plant and 1 SY at Fargo, North Dakota, along with \$400,000 increased funds for this purpose. Similarly, research on ecology and population dynamics in Central America and the Caribbean will necessitate a 1 SY increase and \$200,000. The effort on systemic insecticides should be sustained and expanded to include chemical control technology.

Long-Range Goals

The present goal of eradication is to reach the barrier zone at the Isthmus of Tehuantepec by December 1984. Interest has already been expressed by IICA and Ministers of Agriculture to continue eradication through Central America and the Caribbean. Thus, research to support these future initiatives must continue in strain development, ecology and population dynamics, genetic population characterization, new rearing technologies, and chemical control technologies.

REFERENCE SLIP

JAN 11 1983

TO

Whitten

- | | |
|---|---|
| ☐ ACTION | ☐ NOTE AND RETURN |
| ☐ APPROVAL | ☐ PER PHONE CALL |
| ☐ AS REQUESTED | ☐ RECOMMENDATION |
| ☐ FOR COMMENT | ☐ REPLY FOR SIGNATURE OF |
| ☒ FOR INFORMATION | ☐ RETURNED |
| ☐ INITIALS | ☐ SEE ME |
| ☐ NOTE AND FILE | ☐ YOUR SIGNATURE |

REMARKS



United States
Department of
Agriculture

Animal and
Plant Health
Inspection Service

Wash, D.C. 20250

Subject: Reserach Priorities - Screwworms

Date: JAN 3 1982

To: Ralph Bram, National Program Leader
Insects Affecting Man & Animals, ARS

I concur with your list of research priorities as it applies to screwworms. Research dedication to resolution of eradication problems has brought us this far and I'm confident you'll find the answers needed to carry us through to eradication.

Norvan L. Meyer
Assistant Deputy Administrator
International Programs
Veterinary Services

cc:
Laster
King
1-10183

1/10
pk

1/10/82

SCREWWORM RESEARCH AT FARGO

II. Current ARS Projects

1. Genetics, Physiology, and Behavior of the Screwworm, Cochliomyia hominivorax

- 1 (A). Genetic characterizations of screwworm populations.
 - a. Project began: Sept. 1981.
 - b. \$/year: \$60,000
 - c. SY/year: 0.6
 - d. Completion date: Sept. 1986
 - e. Total resources: \$300,000; 3.0 SY
 - f. Type of research: 50% Basic; 50% Applied
 - g. Anticipated results: Characterizations based upon meiotic chromosome morphology, enzyme morphology, and gamete fertility will provide evidence for genetic compatibility or incompatibility among and between populations of screwworms from different geographic areas.
- 1 (B). Heterosis in screwworms.
 - a. Project began: Jan. 1984.
 - b. \$/year: \$110,000
 - c. SY/year: 1.0
 - d. Completion date: Jan. 1986
 - e. Total resources: \$220,000; 2 SY
 - f. Type of research: 100% Basic
 - g. Anticipated results: Evidence to demonstrate whether or not the use of hybrid vigor is a viable objective for the mass-production of screwworm used in the eradication program.
- 1 (C). Genetic sexing mechanism for screwworms.
 - a. Project began: Jan. 1981
 - b. \$/year: \$40,000
 - c. SY/year: 0.3
 - d. Completion date: Jan. 1986
 - e. Total resources: \$200,000; 1.5 SY
 - f. Type of research: 100% Basic
 - g. Anticipated results: The development of a colony of screwworms with a genetic mechanism for the preferential elimination of females so that only males may be mass-produced.
- 1 (D). Behavioral response of adult screwworms to blossoms and extracts of blossoms of Acacia spp.
 - a. Project began: Sept. 1981
 - b. \$/year: \$23,000
 - c. SY/year: 0.2
 - d. Completion date: Sept. 1986
 - e. Total resources: \$115,000; 1.0 SY
 - f. Type of research: 100% Basic
 - g. Anticipated results: Identification of the chemicals associated with the blossoms which affect the behavior of adult screwworms.

II. Current ARS Projects cont.

2. Cytogenetics of the screwworm
 - a. Project began: Sept. 1982
 - b. \$/year: \$48,800
 - c. SY/year: 1.1
 - d. Completion date: Sept. 1984
 - e. Total resources: \$97,600; 2.2 SY
 - f. Type of research: 80% Basic; 20% Applied
 - g. Anticipated results: The construction of maps of the polytene chromosomes of screwworms will greatly increase the ability of scientists to detect any subtle differences in the morphology of chromosomes among populations of different geographic origin.
3. Attractants, physiology, and behavior of the screwworm.
 - a. Project began: Feb. 1980
 - b. \$/year: \$91,000
 - c. SY/year: 1.0
 - d. Completion date: Feb. 1985
 - e. Total resources: \$455,000; 5.0 SY
 - f. Type of research: 100% Basic
 - g. Anticipated results: The isolation and identification of the natural substances involved in the response of the female screwworm to a wound or a suitable site for oviposition.
4. Microbiological aspects of screwworm fly management.
 - a. Project began: Sept. 1980
 - b. \$/year: \$48,000
 - c. SY/year: 0.3
 - d. Completion date: Sept. 1984
 - e. Total resources: \$192,000; 1.2 SY
 - f. Type of research: 100% Basic
 - g. Anticipated results: A characterization of the bacterial populations associated with the life-cycle stages of the screwworm and the importance of the bacterial species in the biology and behavior of the insect.

III. Project Changes at Location in FY-82

None

IV. Dissemination of Project Results.

Project #	Scientific articles	Articles for the public	Presentations at scientific meeting	Other ^{a/}
1(A)				1
1(C)	1		1	1
1(D)				1
3	1		3	4
4	2		4	2

a/ Primarily joint meetings with USDA-APHIS and its cooperators

SCREWORMS

I. Number of Projects: ARS: 16

SAES: 1

II. Current ARS Projects:

Title	Began	Est. \$(000)	SY	Completion	Est. Total		% Fundamental	% Applied
					\$(000)	SY		
1. Screwworm biology, ecology, and control (Screwworm Research Project, Tuxtla Gutierrez, Mexico)	FY 82	760	6.00	FY 87	3,800	30.0	50	50
a. Screwworm strain development			1.00				0	100
b. SWASS enhancement and attractants			1.00				50	50
c. Genetic characterization of populations			1.00				50	50
d. Screwworm field ecology			2.25				50	50
e. Screwworm population dynamics			0.75				100	0
f. Chemical control			0.25				0	100
2. Improvement of screwworm attractants, SWASS, and diets (Agricultural Products Quality Research, Weslaco, TX)	FY 82	30	0.2	FY 87	300	1.0	75	25
3. Ecology and attractants of wild and laboratory reared screwworm flies (Cooperative Agreement with TX A&M University, College Station, TX)	FY 79	85	0.3	FY 84	425	1.5	20	70
4. Improvement of screwworm diet (Biological Control Research Unit, College Station, TX)	FY 82	30	0.3	FY 84	90	0.9	25	75
5. Genetics, physiology, and behavior of the screwworm, <u>Cochliomyia hominivorax</u> (Screwworm Research Project, Metabolism & Radiation Research Laboratory (MRRL) Fargo, North Dakota)	FY 82	300	3.0	FY 86	1,500	15.0	50	50
a. Genetic characterizations of screwworm populations	1981		0.6	1986		3.0	50	50
b. Heterosis in screwworms	1984		1.0	1986		2.0	100	0
c. Genetic sexing mechanism for screwworms	1981		0.3	1986		1.5	100	0
d. Behavioral response of adult screwworms to blossoms and extracts	1981		0.2	1986		1.0	100	0

II. Current ARS Projects (continued):

Title	Began	Est.	SY	Completion	Est. Total		% Fundamental	% Applied
		\$(000)			\$(000)	SY		
6. Cytogenetics of the screwworm (Insect Genetics & Cell Biology Research, MRRL, Fargo, ND)	1982	49	1.1	1984	98	2.2	80	20
7. Attractants, physiology, and behavior of the screwworm (Insect Physiology & Metabolism Research, MRRL, Fargo, ND)	1980	91	1.0	1985	455	5.0	100	0
8. Microbiological aspects of screwworm fly management (Cooperative agreement with North Dakota State University, Fargo, ND)	1980	48	0.3	1984	192	1.2	100	0

Anticipated Results:

- 1a. Provide the Mexico-American Screwworm Commission with at least 1 screwworm strain per year for use in mass production.
- 1b. Improve SWASS formulation by 100%; develop new screwworm attractants for use in surveillance and supplementary control technology.
- 1c. Characterize the genetic aspects of screwworm populations in various geographic areas of southern Mexico, Central America, and the Caribbean; determine compatibility of production strains with wild populations.
- 1d. Establish the parameters that influence screwworm fly distribution and movement from one geographical area to another in different ecological areas of southern Mexico, Central America, and the Caribbean.
- 1e. Provide information on the dynamics of screwworm population density which can be used for both implementation in and assessment of the eradication program.
- 1f. Provide chemicals to effectively treat cattle moving from screwworm infested areas to areas of Mexico and the United States which have been eradicated.
2. Develop the screwworm attractant, Swormlure-2 and SWASS pellets for use in tropical conditions and to provide research for the development of screwworm adult and larval diets.
3. Discover natural attractants of the screwworm fly; identify genetic changes in mass-produced flies as production progresses.
4. Provide a geletinized larval diet for improved and more efficient screwworm mass production.

Anticipated Results (continued):

- 5a. Characterizations based upon meiotic chromosome morphology, enzyme morphology, and gamete fertility will provide evidence for genetic compatibility or incompatibility among and between populations of screwworms from different geographic areas.
- 5b. Evidence to demonstrate whether or not the use of hybrid vigor is a viable objective for the mass-production of screwworm used in the eradication program.
- 5c. The development of a colony of screwworms with a genetic mechanism for the preferential elimination of females so that only males may be mass produced.
- 5d. Identification of the chemicals associated with the blossoms which affect the behavior of adult screwworms.
6. The construction of maps of the polytene chromosomes of screwworms will greatly increase the ability of scientists to detect any subtle differences in the morphology of chromosomes among populations of different geographic origin.
7. The isolation and identification of the natural substances involved in the response of the female screwworm to a wound or a suitable site for oviposition.
8. A characterization of the bacterial populations associated with the life-cycle stages of the screwworm and the importance of the bacterial species in the biology and behavior of the insect.

III. Project Changes and Location:FY 81

None

FY 82

1. Screwworm research at Mission, Texas was closed and research activities gradually shifted to Tuxtla Gutierrez, Mexico and Fargo, North Dakota; this was required because the APHIS screwworm plant was closed and research with live screwworm could no longer be conducted at the Mission location; furthermore, it is necessary for research scientists to be physically associated with methods development personnel and screwworm production activities.

Current (Project # from II above):

1. Screwworm Research, Tuxtla Gutierrez, Mexico
2. Subtropical Research Laboratory, Weslaco, Texas
3. Texas A&M University, College Station, Texas
4. Veterinary Toxicology & Entomology Research Laboratory, College Station, Texas
- 5-8. Metabolism & Radiation Research Laboratory, Fargo, North Dakota

IV. Dissemination of Project Results (FY 81-83):

<u>Project # from II above</u>	<u>Papers in scientific journals</u>	<u>Articles in media</u>	<u>Presentations at scientific meetings</u>	<u>Presentations at consumer meetings</u>	<u>Other*</u>
1	13		8	14	85
2	4		2	8	
5a	1			3	10
5c	1		1	3	3
5d				3	3
7	1		3	2	6
8	2		4	4	4
 TOTAL	 22		 18	 37	 111

* Joint meetings between USDA, APHIS, and their cooperators, including research/methods development planning meetings, and individual contacts between scientists and methods development or program personnel.

To: ARS Fargo
From: Ralph Bram
Date: THU 27-OCT-83 14:08:57 EDT
Subject: Message for Jim Whitten

Briefing Paper

- 1. Subject: Screwworms
- 2. History and Current Status of Problem:

The screwworm program is, perhaps, the premier example of fundamental research by ARS scientists leading to field evaluation of a new concept and, finally, to the development and implementation of an operational program by APHIS of unparalleled success. It is currently estimated that screwworm eradication provides savings to the livestock industry in excess of \$350 million per year in the U.S. alone. From the inception of the program, ARS has continued to provide research support.

Although the screwworm eradication program has had a history of periods of rapid advancements followed by delays or even setbacks and progress again, the overall status is one of complete screwworm eradication from the U.S. (it has been a year since even the last introduced case has occurred) and eradication through a substantial part of Mexico. Progress during the past year has been so noteworthy that program officials are optimistic of establishing a barrier zone at the Isthmus of Tehuantepec by December of 1984.

Countries of Central America and the Caribbean have expressed strong interest in continuing eradication and establishing a barrier zone in Panama. Although technically feasible, international political realities cast serious doubt on this possibility in the immediate future for Central America, at least.

- 3. Past ARS Research:

ARS has traditionally maintained its major screwworm research facility at the same location as the screwworm program production plant, thereby stimulating greater interaction between program and research personnel and assuring rapid responsiveness to program needs. Until 1982, the major research activity was at Mission, Texas, with a small contingent at Tuxtla Gutierrez, Mexico, and a fundamental research effort at the Metabolism and Radiation Research Laboratory, Fargo, North Dakota. In 1982, APHIS closed the screwworm production plant at Mission and moved all production to a new facility at Tuxtla Gutierrez, Mexico. At that time, ARS also moved research facilities to accommodate the program as follows:

Location	SY	\$(000)
Tuxtla Gutierrez	5.0	\$000,000
Fargo	3.0	000.000

A limited amount of supporting research of a specialized nature is also conducted at Weslaco, Texas (screwworm attraction), and College Station, Texas (diet improvement), and Berkeley, California (screwworm attractants).

Since screwworm eradication began, ARS has been responsible for providing a screwworm strain for use in the production facility and strain development

- 2 -

is considered by APHIS as their highest priority. Thus, each year ARS develops one primary and one secondary strain for program use. Although not conducive to extensive publication, this effort is of tremendous practical value and is equivalent to research of the highest quality and priority.

Fundamental research on screwworm biology and ecology in different environmental areas forms the foundation of the program and is essential to the development of effective eradication strategies. ARS scientists have also been responsible for research and development of methods for handling and releasing sterile flies. Fundamental research on the genetic characterization of screwworm populations has shown that reproductive isolation does not exist in the areas so far investigated, thus relieving anxiety that sympatric, reproductively isolated populations could jeopardize the program.

ARS scientists developed a screwworm adult suppression system (SWASS) to complement the sterile male technique of eradication. Consisting of an attractant bait and toxicant, SWASS attracts and kills screwworm adults and, by reducing the wild adult population, make the sterile insect technique more effective. SWASS is particularly effective in emergency actions to eliminate introduced foci of screwworms from previously eradicated areas.

When availability of suitable meat and cost considerations presented a problem for the production of adequate numbers of sterile males, ARS scientists pursued basic and applied research to provide a hydroponic diet and new rearing techniques which became the standard for production.

- 4. Present ARS Research:

The current ARS screwworm research program consists of a balanced fundamental and applied scientific effort at Tuxtla Gutierrez, Mexico, with mission-oriented fundamental research at Fargo, North Dakota. Major research areas are as follows:

Research Area	Location	SY
Strain development SWASS enhancement and attractants	Tuxtla Gutierrez	1.0
	Tuxtla Gutierrez	1.0
	Fargo	1.25
	Weslaco	0.25
	Berkeley	0.10
Genetic characterization of populations	Tuxtla Gutierrez	1.0
	Fargo	0.8
	Fargo	1.0
Heterosis	Tuxtla Gutierrez	2.25
Field ecology	Fargo	0.50
All male strain	College Station	0.25
Nutrition and growth	Tuxtla Gutierrez	0.75
Population dynamics	Tuxtla Gutierrez	0.25
Chemical control	Tuxtla Gutierrez	0.25

- 5. Current Work and Role of Other Performers:

In addition to ARS research, the Mexico-American Screwworm Commission conducts methods development and quality control activities in Mexico. This

- 3 -

effort is closely coordinated with the research effort in order to bring newly developed information directly to program as quickly as possible. In addition to the daily interactions of research and methods development personnel, an annual research and methods development planning session is held in order to formally establish research and methods development priorities and assure necessary cooperative activities.

Due to the quarantinable nature of screwworm research in the U.S. (live screwworms are permitted only at the Fargo location), no research is conducted independently by agencies outside of ARS. Cooperative agreements exist with North Dakota State University (screwworm attractants and fundamental genetics), Texas A&M (field investigations in Mexico), Iowa State University (new strategies for eradication), and Health Chem (SWASS enhancement)

- 6. ARS Needs and Approaches for the Future:

Although the screwworm program continues to make progress towards establishing a barrier zone in December 1984, research on the fundamental and applied aspects of strain development, field ecology, genetics, attraction and population dynamics must continue to receive substantial, undiminished support. Future initiatives should address basic genetic research, nutrition and growth, and strain deterioration under conditions of mass production. Prior to proceeding into Central America and the Caribbean, field investigations will be necessary on the biology, ecology, population dynamics, and genetics of populations in the new areas.

- 7. Recommended ARS Action:

Additional resources to identify those genetic and environmental factors which contribute to the deterioration of screwworm strains under conditions of mass production will be needed in 1985. Other research thrusts can be accomplished through redirections of scientists and funds already within the screwworm research program, provided adjustments for inflation are maintained.

Command:

of populations of screwworms of different geographic origin thus far has not detected any evidence for reproductive isolation mechanism real or potential, ~

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REFERENCE SLIP

11-18-83

TO

C. J. Whitten

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ACTION

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NOTE AND RETURN

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APPROVAL

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PER PHONE CALL

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AS REQUESTED

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RECOMMENDATION

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FOR INFORMATION

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INITIALS

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SEE ME

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NOTE AND FILE

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YOUR SIGNATURE

REMARKS

FROM

R. A. Bram

RESEARCH PRIORITIES FOR MAJOR VETERINARY SERVICES PROGRAMSWorking Group (WG): ScrewwormStaff: International Operations & Screwworm Staff FY 1986

Suggested VS Members:

Suggested ARS Members:

Chairperson *F. E. SmithChairperson * R. A. BramMember W. H. SudlowMember O. H. GrahamMember H. C. HofmannMember C. J. WhittenMember J. E. Novy

Member _____

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Research Needs	WG Need Rank	Research Project (* = ongoing projects)	Date: B/E B=Beginning E=Ending	Location	How Funded	Est. Annual Cost	WG Projec Rank
New factory strain development		*Development of factory strains at Tuxtla Gutierrez	Yearly	Tuxtla Gutierrez	ARS	200,000	1
Better understanding of the ecology and population dynamics and population Genetics in Mexico, C.A., and the Caribbean		Study of the ecology and population dynamics and population genetics in Mexico, C.A., and the Caribbean	B - 1980 E - Open	Tuxtla Gutierrez	ARS	400,000	2
Identification and characterization of Environmental and Genetic Factors which contribute to strain deterioration etc.		Discover techniques which indicate competitive status of screwworm strains and can be used to predict the rate of deterioration	B - 1984 E - open	Tuxtla	ARS	200,000	3
*Improvement in rearing consistently high quality screwworms		*Develop improved rearing techniques to produce a higher and more consistent larval weight including nutrition, mechanical handling and feeding systems	B - 1985 E - 1986	Tuxtla Gutierrez	ARS	200,000	4

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SK

RESEARCH PRIORITIES FOR MAJOR VETERINARY SERVICES PROGRAMS (continued)

Working Group (WG): Screwworm Fiscal Year: 86

(1)	(2) WG Need Rank	(3) Research Project (* = ongoing projects)	(4) Date: B/E B=Beginning E=Ending	(5) Location	(6) How Funded	(7) Est. Annual Cost	(8) WG Project Rank
New improved formulation and methods of Applications of SWASS for use within the barrier and for emergency treatment		Test new SWASS formulations and methods of application for effectiveness in selected areas of the barrier and the area in front of the barrier	B - 1984 E - Open	Tuxtla Gutierrez	ARS	300,000	5
Understanding of Fundamental Genetics of Screwworm		Apply modern Genetic techniques to screwworm population characterization	1984 Open	Fargo	ARS	150,000	6
Develop new more effective attractants for mating assembly and oviposition		Study Effectiveness of Attractants *Trials of the following attractants:					7
		- Wound Attractants	B - 1980 E - Open	Fargo, ND Tuxtla, Gutierrez Berkeley, CA	ARS ARS ARS	144,000 10,000 5,000	= = =
		- Dried Blood Attractants	B - 1981 E - 1985	Fargo, ND Tuxtla, Gutierrez Berkeley, CA	ARS ARS ARS	50,000 25,000 5,000	= = =
		- Flower Attractants	B - 1981 E - Open	Fargo, ND Tuxtla, Gutierrez Berkeley, CA	ARS ARS ARS	36,000 25,000 15,000	= = =
		- Calf Navel Cord Attractants	B - June 82 E - Open	Weslaco, TX Fargo, ND Tuxtla, Gutierrez	ARS ARS ARS	15,000 5,000 5,000	= = =
		* Oviposition Stimulants	B - 1982 E - Open	Tuxtla, Gutierrez Fargo, ND	ARS ARS	60,000 10,000	= =
		*Trap Improvements	B - FY 83 E - FY 85	Tuxtla, Gutierrez	ARS	100,000	=

RESEARCH PRIORITIES FOR MAJOR VETERINARY SERVICES PROGRAMSWorking Group (WG): ScrewwormStaff: International Operations & Screwworm Staff FY 1987

Suggested VS Members:

Suggested ARS Members:

Chairperson *F. E. SmithChairperson * R. A. BramMember W. H. SudlowMember O. H. GrahamMember H. C. HofmannMember C. J. WhittenMember J. E. NovyMember

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Research Needs	WG Need Rank	Research Project (* = ongoing projects)	Date: B/E B=Beginning E=Ending	Location	How Funded	Est. Annual Cost	WG Project Rank
New factory strain development		*Development of factory strains at Tuxtla Gutierrez	Yearly	Tuxtla Gutierrez	ARS	200,000	1
Better understanding of the ecology and population dynamics and population Genetics in Mexico, C.A., and the Caribbean		Study of the ecology and population dynamics and population genetics in Mexico, C.A., and the Caribbean	B - 1980 E - Open	Tuxtla Gutierrez	ARS	400,000	2
Identification and characterization of Environmental and Genetic Factors which contribute to strain deterior etc.		Discover techniques which indicate competitive status of screwworm strains and can be used to predict the rate of deterioration	B - 1984 E - open	Tuxtla	ARS	200,000	3
*Improvement in rearing consistently high quality screwworms		*Develop improved rearing techniques to produce a higher and more consistent larval weight including nutrition, mechanical handling and feeding systems	B - 1985 E - 1986	Tuxtla Gutierrez	ARS	200,000	4

RESEARCH PRIORITIES FOR MAJOR VETERINARY SERVICES PROGRAMS (continued)

Working Group (WG): Screwworm Fiscal Year: 87

(1)	(2) WG Need Rank	(3) Research Project (* = ongoing projects)	(4) Date: B/E B=Beginning E=Ending	(5) Location	(6) How Funded	(7) Est. Annual Cost	(8) WG Project Rank
New improved formulation and methods of Applications of SWASS for use within the barrier and for emergency treatment		Test new SWASS formulations and methods of application for effectiveness in selected areas of the barrier and the area in front of the barrier	B - 1984 E - Open	Tuxtla Gutierrez	ARS	300,000	5
Understanding of Fundamental Genetics of Screwworm		Apply modern Genetic techniques to screwworm population characterization	1984 Open	Fargo	ARS	150,000	6
Develop new more effective attractants for mating assembly and oviposition		Study Effectiveness of Attractants *Trials of the following attractants:					7
		- Wound Attractants	B - 1980 E - Open	Fargo, ND Tuxtla, Gutierrez Berkeley, CA	ARS ARS ARS	144,000 10,000 5,000	= = =
		- Dried Blood Attractants	B - 1981 E - 1985	Fargo, ND Tuxtla, Gutierrez Berkeley, CA	ARS ARS ARS	50,000 25,000 5,000	= = =
		- Flower Attractants	B - 1981 E - Open	Fargo, ND Tuxtla, Gutierrez Berkeley, CA	ARS ARS ARS	36,000 25,000 15,000	= = =
		- Calf Navel Cord Attractants	B - June 82 E - Open	Weslaco, TX Fargo, ND Tuxtla, Gutierrez	ARS ARS ARS	15,000 5,000 5,000	= = =
		* Oviposition Stimulants	B - 1982 E - Open	Tuxtla, Gutierrez Fargo, ND	ARS ARS ARS	60,000 10,000	= =
		*Trap Improvements	B - FY 83 E - FY 85	Tuxtla, Gutierrez	ARS	100,000	=

RESEARCH PRIORITIES FOR MAJOR VETERINARY SERVICES PROGRAMS (continued)

Working Group (WG): Screwworm

Fiscal Year: 88

(1)	(2) WG Need Rank	(3) Research Project (* ongoing projects)	(4) Date: B/E B=Beginning E=Ending	(5) Location	(6) How Funded	(7) Est. Annual Cost	(8) WG Project Rank
Research Needs							
Review and study of more effective systemic and conventional insecticides for use in conjunction with quarantine stations		Test more insecticides for use as sprays, injectibles, and dipping at quarantine stations	B - 1983 E - Open	Tuxtla Gutierrez	ARS ARS	100,000	6

By the year 1988 the barrier zone should have been fully operative 2 years or more. Interest has already been expressed by IICA and the ministers of Agriculture to continue eradication through Central Amercia and the Caribbean. Thus, research for the barrier program should be focused primarily to improve quarantine procedures and improving sterile insect quality continuing strain development and other research projects, to insure that no fertile insects enter the barrier and that if they do their progeny are eliminated by the sterile male technique. Research to support future initiatives in Central America must continue in strain development, ecology and population dynamics, genetic population characterization, new rearing technologies, and chemical control technologies.

5 Jan. 84

Ralph,

Enclosed are a number of items, some of which may be classified as a "Care Package".

1. A resume from Don Vacek who is presently in Australia but will be returning to the U.S. soon. Don contacted me through Bob Mangan about the polytene research associate job for which we hired Vas Dev. I hope we will have hired the entomologist to do the heterosis work before Vacek returns--the position recruitment action (notification) is to be out in mid-January.

2. An assortment of publications on mitochondrial DNA provided by Rich Rhoerdanz, the geneticist in George Gassner's group. Rich is completing studies with at least 7 different restriction enzymes and 4 lines of C. hominivorax, (009, Jamaica, CIH-34 from Colima, and MN-48 from Michoacan) and has the insect material to characterize C. macellaria. To date he has found some minor (he considers) differences between the lines and the enzymes he has used. These differences primarily are between Jamaica and the others. He assures me that he hopes to get a manuscript out on this work. I hope so because I suspect that Richardson, et al are planning to take this approach from material they hoped to collect in Belize during the holiday break. It would certainly be nice to beat them to the "punch".

4. Vas Dev is continuing his work with the polytenes and hopes to have a map soon. At the present he is working to be sure that he has all the arms properly matched and identified.

5. With respect to the draft(?) of Research Priorities for Major Veterinary Services Programs I have several comments, even though they may be too late. I'm not sure that I understand the Project Rank--is this the same as priority? Also, I feel that the Fargo lab can contribute to the second and third research needs. We are in a position to receive (and have received) frozen specimens from Costa Rica that can be used for comparative studies of enzyme and chromosome morphology. Also, I believe that some of our current research (such as the extent of laboratory adaptation as demonstrated in the mating preference tests) could be applicable to be developed as a quality monitoring technique for factory produced flies. Also, what happened to the genetic sexing mechanism?

6. Al Heacox (who works with Roger Leopold) has asked for some eggs, so hopefully they are ready to begin working with screwworms.

ARS SCREWORM ATTRACTION RESEARCH
Current Activities by Location

Research Activity	Fargo, ND	Tuxtla Gutierrez	Weslaco, TX	Berkeley, CA	Other Locations
SWASS enhancement		Field evaluation of existing and new formulations in different ecosystems (Mackley, Sudlow, Brown)	Development of new wax formulations and pellet sizes (Brown, Sudlow, Mackley)		Proposal requested from Hercon for development of slow-release formulation and system base on pheromone release devices (Beroza)
Swormlure enhancement		With the development of swormlure IV no further adjustments in standard component proportions will be made (Mackley, Brown)			
Flower attractants	Bioassay (olfactometer) evaluation of volitile fractions to active components of acacia (Whitten, Spencer)	Discover attractive flora in humid tropics (Mackley, Brenner) Collect flowers of attractive plant spp. (Mackley)		Isolate and characterize volitile fractions (3 spp. of acacia have already been characterized) (Flath)	Plant identifications are being made by
Dried blood attractants	Isolate active fractions through bioassay (olfactometer) of steam distillates (Pomonis, Hammack)	Field evaluation of steam distillates (Mackley)		Identify and characterize active fractions (Flath)	

Identify & characterize Pomonis
 → 20% reconstituted dried blood steam distilled - separation by HPLC

385

Research Activity	Fargo, ND	Tuxtla Gutierrez	Weslaco, TX	Berkeley, CA	Other Locations
Bacterial attractants	Isolate active fractions through bioassay (olfactometer) of steam distillates (Bromel, Hammack, Pomonis)	Field evaluation of whole bacterial media and fractions of steam distillates (Mackley)		Identify and characterize active fractions (Flath)	
Calf naval cord attractants	Bioassay (olfactometer) of active fractions (Hammack)	Cage evaluation (jar preference tests) of attractive fractions; field evaluation of active fractions (Mackley, Brown, Sudlow)	Collection and preservation of naval cord tissue; isolation of attractive fractions (Brown, Sudlow)	Identify and characterize active fractions (Flath)	
Manure attractants				1962 Hightower 1936 Kneppling in Valdosta	Kansas State U is isolating active fractions for attraction of face flies; may be applicable to screwworm attraction (Broce)
Trap improvement		Fundamental research and field evaluation of trap design (Peterson)			

Research Activity	Fargo, ND	Tuxtla Gutierrez	Weslaco, TX	Berkeley, CA	Other Locations
Oviposition stimulant	Fundamental factors in fresh blood that stimu- late oviposition (Nelson, Pomonis)	Apply active fractions of dried blood, bacteria, calf naval cord to sentinal sheep as a bioassay technique (Graham)			

1. Screwworm

2. Whitten, Chandler J.

Research Entomologist, Screwworm Project Leader

1.0

5.0, 2.5 - Mission, Texas; 2.5 - Fargo, ND

3. Genetic characterization of screwworm populations from different geographic areas based upon chromosome and gene product morphology.

Development of a genetic sexing mechanism for preferentially producing only males.

Characterization of laboratory mating behavior and compatability among screwworms from different populations.

4. Refinement of strain development and subsequent introduction into mass rearing regimen so as to reduce genetic bottlenecks and contamination.

Conducted field tests which satisfactorily indicated that screwworms from the east coast of Mexico were not reproductively isolated from those of the west coast and vice versa.

Perfomed isozyme analyses of screwworm populations from Mexico and Central America and found no evidence of reproductive isolation.

Developed technique to produce polytene chromosomes from screwworms (with research associate through cooperative agreement).

5. To continue studies involving potential reproductive isolation that might be encountered by an eradication program.

To develop a genetic sexing mechanism in screwworms so as to allow the eradication program to reduce rearing costs or to rear twice as many males.

To study the formal genetics of the screwworm to improve our ability to detect and retard strain deterioration.

2. Research Objectives:

A concise bulletpoint statement is expected or sought for research achievement and what relevance it will have to the problem solution.

Command: READ 1

USDA 27-JAN-84 10:08:19 050 1

To: ARS Fargo
From: Ralph Bram
Date: FRI 27-JAN-84 10:08:19 EST
Subject: Message for Jim Whitten from Bram

Date:

ARS RESEARCH

1. Problem: (e.g. Boll Weevil)
 2. Scientist Name: *Whitten*
Title:
Location:
SY: (FY 84, to nearest 0.1)
SY: (cumulative effort 1979-83, not to exceed 5.0)
 3. Current Research:
 - o (concise, bullet-type statement; no more than two lines for each research thrust.)
Genetic characterization
Genetic sexing
 4. Accomplishments (1979-1983):
 - o (within last 5 years; specific research accomplishments related to the problem; state both the accomplishment and its importance to the problem, include significant research progress milestones and technological achievements; use concise, bullet-type statements; no more than two lines for each accomplishment.)
Test for reproductive isolation
 5. Research Goal(s):
 - o (concise bullet-type statement on expected or sought for research achievement and what relevance it will have to the problem solution.)
-

Command: READ 1

USDA 27-JAN-84 10:08:19 050 1

To: ARS Fargo
From: Ralph Bram
Date: FRI 27-JAN-84 10:08:19 EST
Subject: Message for Jim Whitten from Bram

Date:

ARS RESEARCH

1. Problem: Screwworm fly

2. Scientist Name: Leslie Hammack
Title: Research Entomologist
SY: 1.0
SY: 5.0 cumulative

3, not to exceed 5.0)

3. Current Research:

- Investigate the role of chemical stimuli in host-finding and ovipositional behaviors.
- Investigate the role of sex pheromones in mating behavior.
- Cooperate with a chemist in the isolation and identification of behaviorally-active compounds.

4. Accomplishments (1979-1983):

(within last 5 years: specific)

- Odors attractive to gravid flies were demonstrated in wounds but only under conditions consistent with their production by bacterial contaminants.
- Variables operating prior to the pupal stage were found to affect attraction and oviposition responses of adults reared in the laboratory.
- Protein-feeding tests with vitellogenic females indicated the existence in attractive blood of a feeding attractant for immature flies.
- P. rettgeri metabolites were highly attractive but only to gravid females suggesting bacterial production of an ovipositional attractant.
- Fully recovered attractant in a combination of 4 HPLC fractions providing the means to continue isolation of chemicals attractive only when recombined.
- Developed a simple bioassay for contact sex pheromone, demonstrated it in female extracts, and detected strain differences correlated with colonization.

5. Research Goal(s):

o (concise bullet-type statement on expected or sought for research achievement and what relevance it will have to the problem solution.)

- Development of a chemical bait attracting gravid females for applications in population monitoring and mass-rearing operations.
- Demonstrate that current methods of laboratory colonization affect sex pheromone production and may detrimentally affect the mating competitiveness of mass-reared insects.

Command: READ 1

USDA 27-JAN-84 10:08:19 050 1

To: ARS Fargo
From: Ralph Bram
Date: FRI 27-JAN-84 10:08:19 EST
Subject: Message for Jim Whitten from Bram

Date:

ARS RESEARCH

1. Problem: *Screwworm*
(e.g. ~~Bell Weevil~~)

2. Scientist Name: *J. George Pomonis*
Title: *Research Chemist*
Location: *NRRL - ARS - Fargo, N.D.*
SY: (FY 84, to nearest 0.1) *0.2*
SY: (cumulative effort 1979-83, not to exceed 5.0)

3. Current Research:

o (concise, bullet-type statement; no more than two lines for each research thrust.)

a. Determine chemical factors ~~involved in~~ *from dried blood* that are attractive to screwworm adults.

b. Determine the biochemical nature and function of surface (cuticular) lipids of screwworm.

4. Accomplishments (1979-1983):

o (within last 5 years; specific research accomplishments related to the problem; state both the accomplishment and its importance to the problem, include significant research progress milestones and technological achievements; use concise, bullet-type statements; no more than two lines for each accomplishment.)

a) Fractions isolated from steam distillate of attractive blood by HPLC indicated 4 fractions were about as attractive to gravid flies as the original distillate, but only when all 4 were combined. With the availability of these 4 fractions, behavioral bioassays can be used to identify chemical isolation procedures that may retain some but not all of the components needed to obtain an attraction response. Some of the active components were obtained in methanol and could be gas chromatographed.

b) The screwworm synthesizes from 85-105 different alkanes depending on age and sex. Adults showed sexual dimorphism in this hydrocarbon gas chromatographic profile. Females showed a preponderance of higher molecular weight hydrocarbons ($C_{33}H_{68}$ - $C_{35}H_{72}$) and males showed a preponderance of $C_{25}H_{52}$ - $C_{27}H_{56}$ hydrocarbons. Colonization for 17 generations or more caused a shift in the quantity of higher molecular weight hydrocarbon of females from $C_{33}H_{68}$ - $C_{29}H_{60}$ but no changes in males.

Command: READ 1

USDA 27-JAN-84 10:08:19 050 1

To: ARS Fargo
From: Ralph Bram
Date: FRI 27-JAN-84 10:08:19 EST
Subject: Message for Jim Whitten from Bram

Date:

ARS RESEARCH

1. Problem: (e.g. Boll Weevil) Screwworm
2. Scientist Name: L.E. LaChance
Title: Res. Geneticist, NTA for Insect Genetics
Location: Fargo, ND
SY: (FY 84, to nearest 0.1) 0.4
SY: (cumulative effort 1979-83, not to exceed 5.0) 1.5 SY
3. Current Research: Cytogenetic Analysis of Mexican and Central American Populations
o (concise, bullet-type statement; no more than two lines for each research thrust.)
 - characterize the karyotypes of screwworm populations originating from various States in Mexico and Central America.
 - determine whether evidence exists that some populations are reproductively isolated.
 - assist other scientists in program at Fargo in studies of screwworm mating behavior, heterosis, and biology.
4. Accomplishments (1979-1983):
o (within last 5 years; specific research accomplishments related to the problem; state both the accomplishment and its importance to the problem, include significant research progress milestones and technological achievements; use concise, bullet-type statements; no more than two lines for each accomplishment.)
 - studies of 13 isofemale lines from 4 States in Mexico indicates no significant chromosome variation that would support reproductive isolation.
5. Research Goal(s):
o (concise bullet-type statement on expected or sought for research achievement and what relevance it will have to the problem solution.)

 - continue studies of screwworm chromosomes from additional collections in Mexico and Central America.
 - develop chromosome banding techniques to further characterize the screwworm populations.
 - assist in planning and design of experiments to test for heterosis in release strains.

Command: READ 1

USDA 27-JAN-84 10:08:19 050 1

To: ARS Fargo
From: Ralph Bram
Date: FRI 27-JAN-84 10:08:19 EST
Subject: Message for Jim Whitten from Bram

Date:

ARS RESEARCH

1. Problem: (e.g. Boll Weevil)
 2. Scientist Name:
 - Title:
 - Location:
 - SY: (FY 84, to nearest 0.1)
 - SY: (cumulative effort 1979-83, not to exceed 5.0)
 3. Current Research:
 - o (concise, bullet-type statement; no more than two lines for each research thrust.)
 4. Accomplishments (1979-1983):
 - o (within last 5 years; specific research accomplishments related to the problem; state both the accomplishment and its importance to the problem, include significant research progress milestones and technological achievements; use concise, bullet-type statements; no more than two lines for each accomplishment.)
 5. Research Goal(s):
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 5. Research Goal(s):
 - o (concise bullet-type statement on expected or sought for research achievement and what relevance it will have to the problem solution.)
-

New Factory strain development - I VS-I-4
Ecology & Population genetics (dynamics) I VS-I-15
Characterization of strain deterioration II VS-II-4
Improved Rearing II VS-II-15
Fundamental genetics II VS-II-17
Attractants III VS-III-1
Quarantine procedures III VS-III-8
SWASS formulations III VS-III-9



United States
Department of
Agriculture

Agricultural
Research
Service

National
Program
Staff

Beltsville, Maryland
20705

August 6, 1986

SUBJECT: APHIS Research Priorities - FY 1988

TO: ✓ C. J. Whitten
Fargo, North Dakota

R. L. Mangan
Tuxtla Gutierrez, Mexico

APHIS has recently provided us with their research priority needs for fiscal year 1988. Enclosed please find proposed screwworm projects in order of priority. For the most part, these priorities are consistent with items discussed at the Screwworm Research and Methods Development Planning Meetings and are currently being addressed at Tuxtla Gutierrez and Fargo.

The item on screwworm quarantine procedures (VS-III-8) is somewhat of a surprise and may, in fact, include methods development as a main component. For clarification purposes, I would suggest that Dr. Mangan specifically discuss this topic with program officials (starting with Dr. Novy) and advise me of their feelings before we initiate any new work.

RALPH A. BRAM
National Program Leader
Insects Affecting Man & Animals
and Parasitology

Enclosures

TITLE: New factory strain development (screwworm)

OBJECTIVE: To develop an acceptable strain of screwworm fly to replace the present factory strain.

WHY NEEDED: Insects reared under factory conditions tend to adapt to those conditions over a period of time which makes the insect less competitive against the native flies.

WORK PLAN: Collect, rear, and evaluate strains of screwworm flies in areas not under sterile fly dispersals. Participate in field tests of candidate strains which have been developed from field collections of screwworm eggs and larvae.

APHIS USES OF THE RESULTS: Experience has shown that the factory strain is subject to unpredictable deterioration within 1 to 2 years after being developed in the laboratory. The changes which occur in the factory strain adversely effect the sterility rate achieved with the release of sterile males. One or more replacement strains should be under development continually so when strain deterioration is detected the new strain can be introduced in the factory without delay.

PRIORITY:

I-Urgent VS-I-4

TITLE: The need to have a better understanding of the ecology and population genetics in Mexico, Central America, Panama, and the Caribbean (screwworm).

OBJECTIVE: Study of the ecology and population genetics in Mexico, Central America, Panama, and the Caribbean including mathematical modeling and tagging technology.

WHY NEEDED: In order to protect the U.S. Department of Agriculture's investment in screwworm eradication, a permanent barrier of sterile fly dispersals must be maintained at some point. Presently, the point is the Isthmus of Tehuantepec in Mexico. The cost of barrier maintenance and the risk of reinfesting Mexico and the United States can be greatly reduced by complete eradication from the Caribbean Islands and Central America so that the barrier can then be established at the Isthmus of Panama. The smaller land area there means a significant reduction in the numbers of flies and dispersal flight miles needed to hold the screwworm at bay.

WORK PLAN: Study population dynamics with field collection techniques designed to predict population levels through the year and throughout the region. The development of computer programs which will account for weather data and susceptible animal densities to suggest the concentrations of sterile flies needed for control and eradication.

APHIS USES OF THE RESULTS: By knowing how to calculate the optimum number of sterile flies per square mile needed to effect an efficacious sterility rate in the varying conditions present in the region, we can minimize total program costs.

PRIORITY:

I-Urgent VS-I-15

TITLE: Identification and characterization of environmental and genetic factors which contribute to strain deterioration, etc. (screwworm).

OBJECTIVE: Discover techniques which indicate competitive status of screwworm strains and which can be used to predict the rate of deterioration.

WHY NEEDED: The techniques of mass production apparently involve certain genetic "bottlenecks" which discriminate against characteristics which make the screwworm fly competitive when released in the field. This loss of "field competitiveness" forces program managers to use greater numbers of flies to complete program objectives. As time goes by, it costs more and more to achieve desired results.

WORK PLAN: A thorough study of present production techniques with the objective of identifying "bottlenecks" and the genetic characteristics which are changed. The development of tests to measure the rate of change in the characteristics which are identified.

APHIS USES OF THE RESULTS: Presently, the plant strain can be changed on a set schedule or when it is obvious to everyone that the strain has gone bad. Strain changes are costly and leave the program vulnerable for a short time in case outbreaks occur which would require more production quickly. If we can reduce the number of strain changes and know when a change will be needed before it is obvious, the level of protection can be maintained at a lower cost.

PRIORITY:

II-Moderately Urgent VS-II-14

TITLE: Improvement in rearing consistently high quality screwworms

OBJECTIVE: To develop improved rearing techniques including nutrition, mechanical handling, and feeding systems to produce a higher and more consistent larval weight.

WHY NEEDED: Larval weight is directly related to fly size which is apparently related to field competitiveness. All other things being equal, it is assumed that uniformly large flies are more effective than a mix of very small and very large flies.

Heterosi

WORK PLAN: Modification of rearing techniques to reduce "human negligence factors" which now result in a wide range of larval sizes in each "batch" of worms produced. Included would be the development of quality production tests which could be applied throughout the rearing process.

APHIS USES OF THE RESULTS: It probably would cost no more to produce the same number of more effective, high quality flies. The production of a consistently high quality fly would reduce the number of flies needed. Reduced numbers of flies needed would reduce costs.

PRIORITY:

II-Moderately Urgent VS-II-15

TITLE: Understanding of fundamental genetics of screwworms

OBJECTIVE: To apply modern genetic techniques to screwworm population characterization.

WHY NEEDED: A means of identifying a screwworm population is needed to detect possible sources of screwworm outbreaks when they occur and to predict characteristics in isolated screwworm populations which may make them resistant to the plant strain in use.

WORK PLAN: Use of most recently developed genetic engineering techniques to study and characterize the chromosome and gene variations which are present in a given screwworm population.

APHIS USES OF THE RESULTS: Costly "outbreaks" of screwworms in previously free areas have, in some cases, been suspected of being the result of sabotage by individuals looking for job security. Being able to establish this would lead to better plant security methods. Being able to predict resistant populations before we try to eradicate them would reduce delays and costs in meeting program goals.

PRIORITY:

II-Moderately Urgent VS-II-17

TITLE: Improvement in attractants used for mating assembly and oviposition

OBJECTIVE: Study of known attractants such as found in wounds, dried blood, flowers, calf navels, and presently used oviposition attractants to develop attractants which can be used (1) in traps and (2) as breeding and oviposition stimulants.

WHY NEEDED: A moderately effective attractant has been in use, but there is a need for a more specific attractant which has a wider range of action in varying conditions of terrain, temperature, humidity, etc. The present "stimulant" for breeding and oviposition in the factory is used screwworm media.

WORK PLAN: Laboratory analysis to determine the identification and concentration of biochemical substances which contribute to the attraction of screwworm in various stages of the life cycle.

APHIS USES OF THE RESULTS: A more effective attractant will assist in field trapping studies. The development of an "artificial wound attractant" will aid in measuring the sterility rates of varying sterile fly dispersals. A more effective breeding and oviposition attractant will increase brood colony production in the plant.

PRIORITY:
III-Routine VS-III-7

TITLE: Screwworm quarantine procedures

OBJECTIVE: 1) To improve methods to detect screwworm infested animals at quarantine stations. 2) To determine type of transport vehicles and loads which may carry various life cycle stages of hitchhiking screwworms. 3) To determine most effective type of insecticide to be used at quarantine stations.

WHY NEEDED: The present market route of livestock from screwworm infested areas to screwworm free areas puts a heavy strain on the quarantine facilities on highways and railroads to detect and destroy all stages of the screwworm. Some outbreaks have been traced to the transportation of animals which were checked through routine quarantine station procedures.

WORK PLAN: 1) Study new designs for animal handling facilities which would improve ability to unload, inspect, and load livestock under all conditions encountered at the present quarantine stations. 2) Research on the survivability of various life forms of screwworms under differing systems of transportation to determine if nonanimal transportation could contribute to spread of infestations. 3) Comparative laboratory and field testing of available insecticides to determine the most efficacious product to use in all species.

APHIS USES OF THE RESULTS: The Mexican field force in the part of the country north of the present barrier has been drastically reduced. We cannot rely on the remaining field personnel for the early detection of an outbreak. We must strengthen all aspects of our inspection and quarantine of livestock shipments to reduce the possibility of expensive outbreaks in the screwworm free areas.

PRIORITY:

III-Routine VS-III-8

TITLE: New formulations and methods of application for Screwworm Adult Suppression System (SWASS)

OBJECTIVE: To develop and test improved SWASS formulation to be used in selected areas of Mexico, the Caribbean, and Central America.

WHY NEEDED: SWASS has been used effectively in the drier areas of Texas and Mexico to reduce unusually high populations of screwworms so that subsequent sterile fly dispersals will be more effective. Tests have shown that the present formulation would be relatively ineffective in the humid areas of southern Mexico, in Central America, and in the Caribbean.

WORK PLAN: Studies to determine what changes in the formulation, packaging, and distribution of SWASS would be more effective in the highly humid zones which will be encountered as the program progresses.

APHIS USES OF THE RESULTS: Peculiarities of terrain, animal populations, accessibility, etc., could make some areas resistant to effective treatment with sterile flies. An improved SWASS would be an additional weapon in our fight to prevent reinfestation of the United States and Mexico and to continue eradication to Panama.

PRIORITY:

III-Routine VS-III-9

